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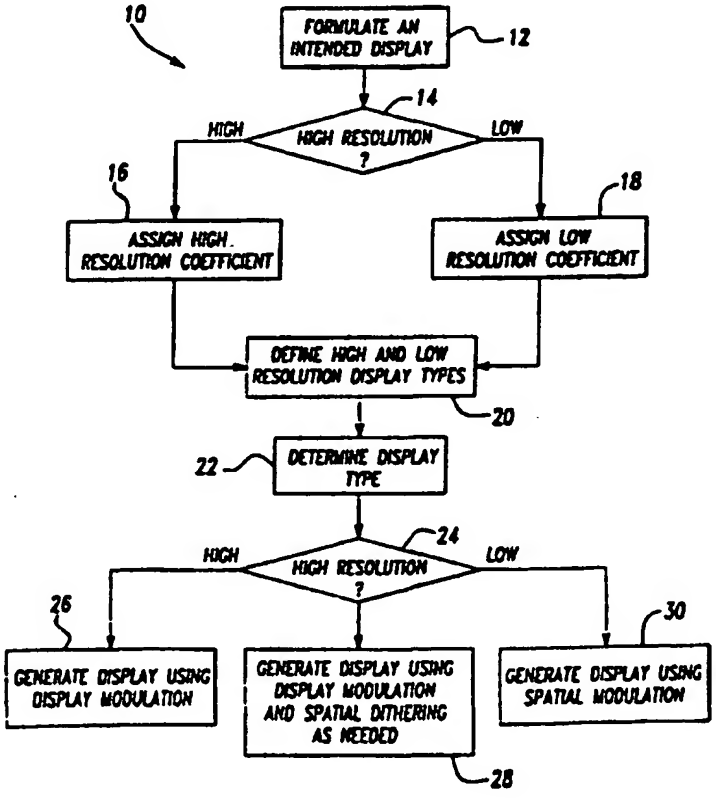
(54) Title: METHOD OF CONTROLLING DISPLAY IMAGE SHADING DEPENDING ON IMAGE RESOLUTION

(57) Abstract

A method of controlling display image shading includes determining whether an image requires high resolution or low resolution shading techniques. When high resolution is required, a frame modulation technique is used. When low resolution is required, a spatial dithering technique is used. This invention also includes partitioning a display into various portions where each portion may require high or low resolution. In such instances, a high resolution technique is used for portions of the display and a low resolution technique is used for other portions of the display as needed.



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METHOD OF CONTROLLING DISPLAY IMAGE SHADING DEPENDING ON IMAGE RESOLUTION

BACKGROUND OF THE INVENTION

This invention relates to a method of controlling visual display image shading. More particularly, this invention relates to a method of choosing between alternative modes of image shading control depending on the level of resolution required for a particular visual display.

Various techniques are used for generating displays on electronic visual display panels. Some current techniques are more complex than others. The more complex techniques typically require more of a computer's memory and may result in higher energy usage within a given system. There is a need for improved utilization of various image shading control techniques, especially in circumstances where computer memory may be limited or power conservation is important.

This invention is a method of utilizing one or more image shading control techniques depending on the type of information to be displayed. More specifically, this invention is a method of choosing between image shading control techniques depending on whether a generated display requires high resolution or low resolution graphics.

SUMMARY OF THE INVENTION

In general terms, this invention is a method of controlling display image shading in an electrical visual display system having a display screen. The method includes several basic steps. First, two display types are defined; a first display type that requires high resolution and a second display type that requires low resolution. A determination is made whether an intended visual display is of the first display type or the second display type. When the intended display is a first display type, the display is generated on the display screen using a first image shading technique. When the intended display is a

second display type, the display is generated on the display screen using a second image shading technique. In the preferred embodiment, when a display requires high resolution, frame modulation is the preferred technique of image shading control. In the preferred embodiment, when the display requires low resolution, the preferred image shading technique is spatial dithering.

The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the presently preferred embodiment. The drawings that accompany the detailed description can be described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic illustration of a visual display system.

Figure 2 is a flow chart diagram illustrating the methodology of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 schematically illustrates a visual display system including a computer memory and data processing module 4 and a video controller 6. Information from the computer memory and data processing module 4 is utilized by the video controller 6 to control a visual display displayed on a display screen 8. In the preferred embodiment, the display screen 8 is a flat panel display adapted to provide an electroluminescent display or a liquid crystal display, for example. The video controller 6 is also electrically coupled with various other input devices for receiving and processing information that may be used to modify or generate a display on the display screen 8. Given this specification, one skilled in the art can select from among commercially available microprocessors or develop specific circuitry to realize the data processing module 4 and the controller 6. Similarly, given this specification, one skilled in the art can develop specific code for

programming the controller 6 and module 4 for performing the functions associated with this invention.

Figure 2 contains a flow chart 10 that illustrates the methodology of this invention. This invention optimizes the use of gray shades and colors in flat panel displays by choosing between at least two types of techniques for controlling image shading depending on whether the image requires high resolution or low resolution. In the preferred embodiment, when high resolution is required, a frame modulation technique is utilized. Frame modulation provides high resolution but limited numbers of shades. When low resolution is sufficient, spatial dithering techniques preferably are used. Spatial dithering provides a larger number of shades or colors but cannot yield high resolution. The video controller 6 determines which technique to use based upon the resolution required for a particular display or portion of a display.

In Figure 2 an intended display is formulated at step 12. The intended display may include a variety of types of graphics. For example, if the intended display is a map, there would be graphical illustrations of roads or topography and overlying textual descriptions of roads and locations, for example. When formulating an intended display, the level of resolution that is required for a satisfactory display is determined at the step 14. When high resolution is required, such as for textual displays, a high resolution coefficient is assigned at 16. When low resolution is sufficient, a low resolution coefficient is assigned to a given display at 18. The steps 12 through 18 preferably are accomplished by the memory and data processing module 4 when formulating a databank or set of displays that will be generated on the display screen 8.

The video controller 6 defines high and low resolution display types at 20 depending on the contents of a particular display. In some instances, an entire display will be of one type or the other. In other words, some displays will require high resolution throughout the entire display, while others may require only low resolution throughout the entire display. This invention is not

limited to displays that require high or low resolution across an entire display. Some displays, such as the map example mentioned above, will be able to be generated using high resolution for portions of the display and low resolution for other portions. This invention includes utilizing separate image shading techniques for the various portions of such a display.

The video controller 6 determines the type of display at 22. A decision is made at 24 whether the display requires high resolution image shading. If it requires high resolution, then the display is generated using a frame modulation technique at 26. Developing specific circuitry or software for accomplishing a frame modulation technique can be developed by those skilled in the art and, therefore, need not be further described in this specification.

When low resolution should be used, the video controller 6 generates the display using a spatial dithering technique at 28. Developing specific circuitry or software for accomplishing a spatial dithering technique is within the scope of those skilled in the art and, therefore, need not be further described in this specification.

In those circumstances where a display requires high resolution for some portions of the display but low resolution for other portions, the video controller generates the display using frame modulation techniques and spatial dithering techniques as needed for the various portions of the display at 30.

The above description is exemplary rather than limiting in nature. Variations and modifications to the disclosed embodiment will become apparent to those skilled in the art that do not necessarily depart from the purview and spirit of this invention. Accordingly, the legal scope accorded to this invention can only be determined by studying the following claims.

CLAIMS

What is claimed is:

1. A method of controlling display image shading in an electrical visual display system having a display screen, comprising the steps of:

(A) defining a first display type as one requiring high resolution;

(B) defining a second display type as one requiring low resolution;

(C) determining whether an intended visual display is a first display type or a second display type;

(D) generating the intended display on the display screen using a first mode of image shading when the intended display is a first display type display; and

(E) generating the intended display on the display screen using a second mode of image shading when the intended display is a second display type display.

2. The method of claim 1, wherein step (C) is performed by determining whether an entire intended display is a first or second display type display.

3. The method of claim 1, further comprising partitioning the intended display into portions and wherein step (C) is performed by determining whether each portion is a first or second display type display, respectively.

4. The method of claim 3, wherein steps (D) and (E) are performed with respect to each display portion separately.

5. The method of claim 1, wherein step (A) is performed by preselecting a high resolution coefficient value that corresponds to a display requiring high resolution and wherein step (B) is performed by preselecting a

low resolution coefficient value that corresponds to a display requiring low resolution.

6. The method of claim 5, further comprising the step of preassigning a preselected resolution coefficient value to an intended display before performing steps (C) through (E).

7. The method of claim 6, wherein step (C) is performed by determining the preassigned resolution coefficient value of the intended display.

8. The method of claim 5, further comprising the steps of partitioning the intended display into a plurality of intended display components, preassigning a preselected resolution coefficient value to each intended display component before performing steps (C) through (E) and wherein step (C) is performed by determining the preassigned resolution coefficient of each intended display component.

9. The method of claim 8, wherein step (D) is performed for the display components having a high resolution coefficient and wherein step (E) is performed for the display components having a low resolution coefficient.

10. The method of claim 1, wherein step (D) is performed by using frame modulation.

11. The method of claim 1, wherein step (E) is performed by using spatial dithering.

12. The method of claim 1, further comprising partitioning the intended display into a plurality of display portions wherein each display portion is either a first or second display type and wherein steps (D) and (E)

are simultaneously performed when at least one of the plurality of display portions is a first display type and at least one other display portion is a second display type and the one and one other display portions are simultaneously displayed on the display screen.

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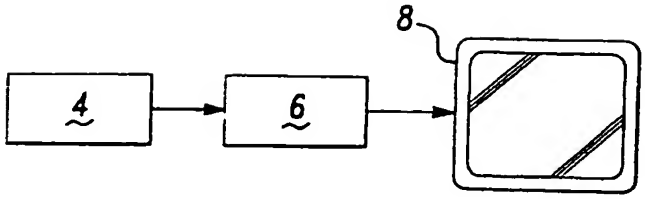
8
4
6

Fig-1

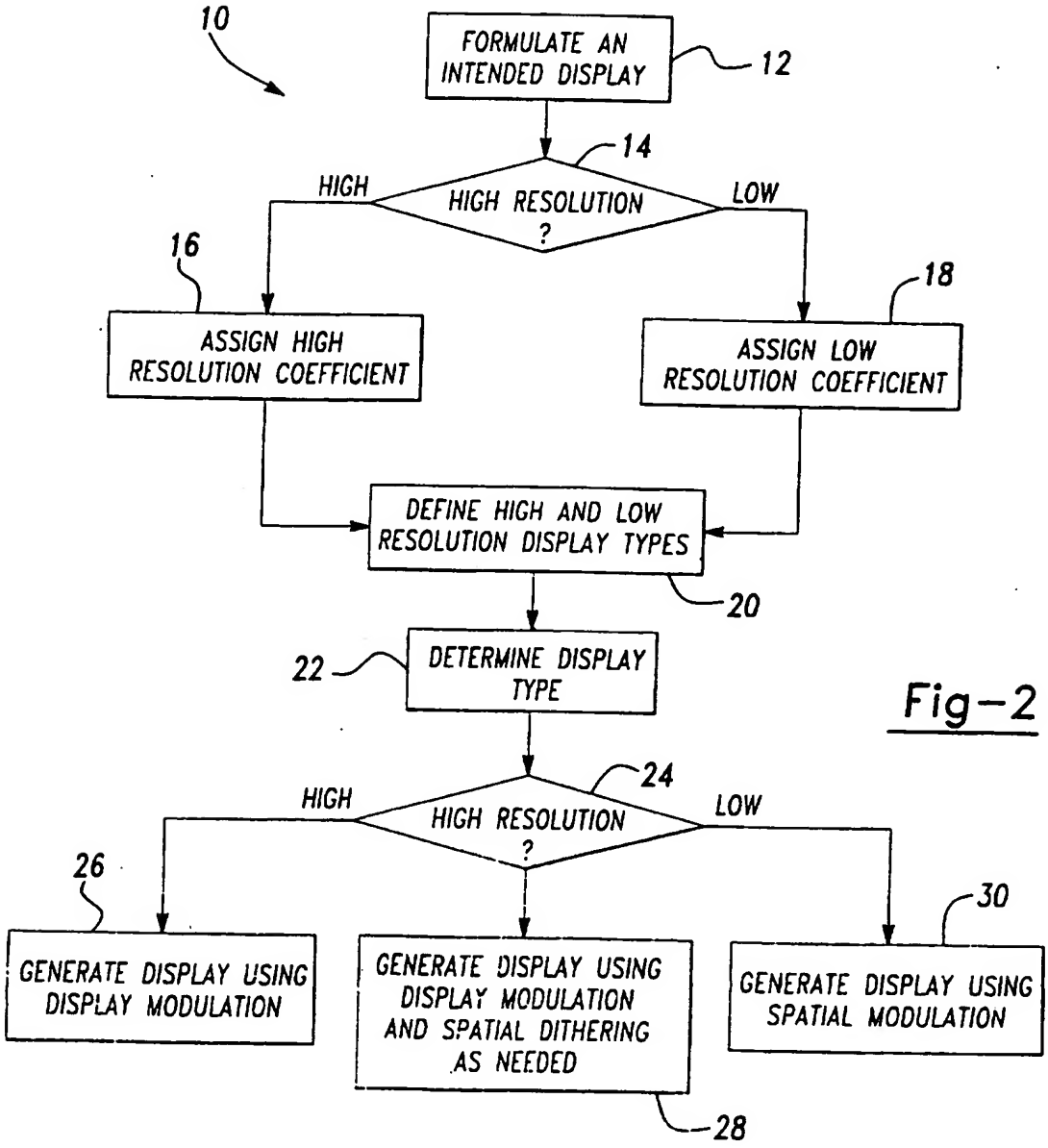
10
FORMULATE AN INTENDED DISPLAY
12
14
HIGH
HIGH RESOLUTION ?
LOW
16
ASSIGN HIGH RESOLUTION COEFFICIENT
18
ASSIGN LOW RESOLUTION COEFFICIENT
DEFINE HIGH AND LOW RESOLUTION DISPLAY TYPES
20
22
DETERMINE DISPLAY TYPE
24
HIGH
HIGH RESOLUTION ?
LOW
26
GENERATE DISPLAY USING DISPLAY MODULATION
GENERATE DISPLAY USING DISPLAY MODULATION AND SPATIAL DITHERING AS NEEDED
28
30
GENERATE DISPLAY USING SPATIAL MODULATION

Fig-2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 97/15100

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G09G3/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G09G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 673 012 A (CANON INFORMATION SYSTEMS RESEARCH AUSTRALIA PTY LTD.) 20 September 1995	1,2,11
A	see Abstract see page 3, line 11 - page 5, line 3; figures 1-7 see page 8, line 36 - line 41 see page 9, line 11 - line 30 see page 9, line 48 - page 10, line 11	3,12

X	US 5 245 328 A (GARRETT) 14 September 1993 see Abstract see column 4, line 55 - column 6, line 2; figures 1-4 see column 9, line 15 - line 36; figure 17	1,2,10, 11

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A	EP 0 570 906 A (CANON K.K.) 24 November 1993 see Abstract see column 13, line 21 - column 15, line 7; figures 2,12-15	3,4,11, 12

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